

Commonwealth of Virginia



Information Technology Resource Management Standard

Spatial Data Transfer Standard (SDTS)

Preface

PUBLICATION DESIGNATION

COV ITRM Standard 94-1.

SUBJECT

Spatial Data Transfer Standard.

SUPERSEDES

COV ITRM Technical Advisory 93-1.

EFFECTIVE DATE

November 18, 1994.

CIM SCHEDULED REVIEW

One (1) year from effective date.

AUTHORITY

Code of Virginia, Section 2.1-563.31 (Powers and Duties of the Council on Information Management).

Code of Virginia, Section 2.1-563.17 (Powers and Duties of the Department of Information Technology).

SCOPE

This standard is applicable to all State agencies and institutions of higher education (hereinafter collectively referred to as "agency") that are engaged in such functions as planning, managing, developing, purchasing and using information technology resources in the Commonwealth. This standard is advisory to local governments and other interested parties.

PURPOSE

To promote and facilitate the transfer of digital spatial data between dissimilar computer systems in the Commonwealth through the adoption of a standard that is compatible with federal standards.

OBJECTIVES

The Commonwealth's SDTS standard will:

- Provide a common mechanism for transferring digital spatial information between dissimilar computer systems, while preserving information meaning and minimizing the need for information external to this standard;
- Provide, for the purpose of transfer, a set of clearly specified spatial objects and relationships to represent real world spatial entities and to specify the ancillary information necessary to accomplish the

transfer; and

- Provide a transfer model that will facilitate the conversion of user-defined to standardized set of objects, relationships, and information.

GENERAL RESPONSIBILITIES

In accordance with the *Code of Virginia*, the following provisions apply:

The Council on Information Management (CIM)

Responsible for directing the development and promulgation of policies, standards, and guidelines for managing information technology resources in the Commonwealth.

Advisory Committees

Responsible for meeting with, conferring and advising the Council in the development of the Commonwealth's policies, standards, and guidelines for managing information technology resources.

The Department of Information Technology (DIT)

Responsible for providing administrative support to the Council and performing such other services as the Council may direct in the performance of its powers and duties. Support may include advising the Council in the development, interpretation, and dissemination of its policies, standards, and guidelines, and maintaining records thereon for the Council.

All State Agencies

Responsible for complying with the Council's policies, standards, and guidelines for managing information technology resources in the Commonwealth.

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SECTION 1

INTRODUCTION

BACKGROUND

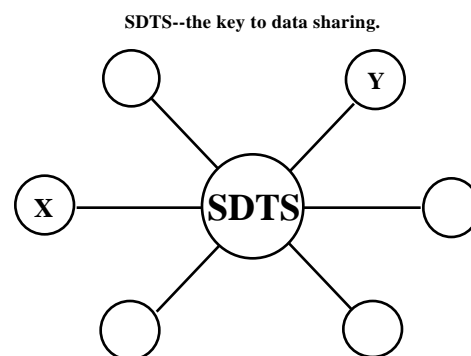
In its October 1990, report on *"Geographic and Biological Land-Use Information and Mapping Systems,"* the Council on Information Management (CIM) agreed to review the *"soon-to-be-released National Institute of Standards and Technology's (NIST) standards on digital cartographic data, digital data exchange, and quality control and documentation."* Based on the findings of that review, the CIM agreed to consider adopting the standard, in whole or in part, for use in the Commonwealth. That NIST standard was originally published as Federal Information Processing Standards (FIPS) Publication 173 - Spatial Data Transfer Standard (SDTS) on August 28, 1992. FIPS 173 was revised and published in 1994 as FIPS 173-1 - Spatial Data Transfer Standard (SDTS). In December 1992, the Council's Advisory Committee on Mapping, Surveying, and Land Information Systems formed an SDTS Project Team to continually evaluate the phased implementation progress of SDTS and to provide the Council with recommendations relative to its use, applicability, and implementation in the Commonwealth.

Based on the SDTS project team's work and the recommendations of the CIM's Advisory Committee on Mapping, Surveying, and Land Information Systems, the Council issued interim guidance on the implementation of SDTS through COV ITRM Technical Advisory 93-1 - Spatial Data Transfer Standard (FIPS-173). This standard supersedes COV ITRM Technical Advisory 93-1.

THE DEVELOPMENT OF SDTS

Work on a national spatial data transfer standard was initiated by the National Committee for Digital Cartographic Data Standards, American Congress on Surveying and Mapping in 1982 to develop a comprehensive set of data exchange standards for the profession. This effort was merged with a parallel Federal government effort and published as a proposed Digital Cartographic Data Standard in 1988. Subsequent testing, modification, and refining of the specifications were done by the Spatial Data Transfer Standard Technical Review Board. These efforts resulted in the issuance SDTS - FIPS 173 in 1992.

Since 1992, efforts have continued to test, modify, and refine the original SDTS specifications. These efforts resulted in the approval and issuance of a revised SDTS FIPS 173-1 on June 10, 1994.



Source - USGS, FIPS 173 Factsheet

SDTS

The SDTS consists of several parts. The first three parts are related but relatively

independent, each dealing with its own piece of the spatial data transfer program.

SDTS Part 1

Part 1 consists of several sections that address the logical specifications in terms of conformance requirements, a conceptual model, quality specifications, the data structure model, and the transfer format.

Section 1 includes a statement of scope and conformance requirements for SDTS. It also includes normative references to other standards and definitions of terms.

The conceptual model of spatial data is presented in Section 2 to provide a framework for defining spatial features and a context for the definition of a set of spatial objects. This conceptual model supports the translation of user data models to and from the SDTS model. Within Section 2 is a defined set of spatial objects, for zero, one, and two dimensions, used in spatial data systems to represent real-world spatial phenomena. Three-dimensional spatial objects have not been specified. The defined set of objects will support the three major types of spatial data operations: (1) geometry only, (2) geometry and topology, and (3) topology only. These objects have been specified in a modular fashion so that more elaborate composite objects can be constructed from them.

Section 3 includes specifications for a quality report concerning the objects in a transfer and their attributes. The purpose of the quality report is to provide detailed information for a user to evaluate the fitness of data for a particular use. The five components of a data quality report are lineage, positional accuracy, attribute accuracy, logical consistency, and completeness. This style of standard can be characterized as "truth in labeling," rather than fixing arbitrary numerical thresholds of quality.

Sections 4 and 5 present specifications for the transfer of spatial data. Section 4 contains general concepts and specifications, the underlying models that pertain to the transfer module specifications of Section 5. Section 4 also specifies the general elements of an implementation, the relationships of the logical constructs of the data models to the general elements of a detailed implementation, and general constraints on the implementation. Finally, Section 4 presents the transfer module specifications conventions used in Section 5. Logical modules consisting of detailed record, field, and subfield specifications are presented in Section 5.

SDTS Part 2

Part 2 addresses data content by providing a standard list and definitions of spatial features and their attributes. This list and definitions are essential to facilitate the transfer of data that is meaningful both to exporters and to importers of the data. This section includes a standard but working and expandable list with definitions of some 200 topographic and hydrographic features and approximately 250 attributes, plus more than 1200 included terms (synonyms or sub-types of standard terms).

SDTS Part 3

Part 3 specifies the implementation of the logical specifications in Part 1 of SDTS using a general data-exchange standard (ISO/ANSI 8211, also known as FIPS 123). This section specifies the allowable subset of tags, names, labels, formats and other control information

necessary to the transfer of spatial data. It specifies the limits allowed users for those ISO 8211 parameters that are permitted to vary such that transfer may be accomplished.

SDTS Part 4

The Topological Vector Profile (TVP), Part 4 of the SDTS, defines a transfer format for topologically structured vector data with planar graph topology. The TVP provides the specifications for vector data sets which contain polygon topology. The TVP was originally designed to facilitate the transfer of standard USGS data sets, which do contain polygon topology. A future network profile will address the transfer standard requirements of network specific data sets.

SDTS Part 5

The draft Raster Profile, Part 5 of the SDTS, defines a transfer format for geo-referenced grid and raster image data sets. Presently these standards are in a draft form with final adoption of the profile expected in late 1994.

FEDERAL IMPLEMENTATION OF SDTS

Currently SDTS provides specifications for the organization and structure of digital spatial data transfer, definition of spatial features and attributes, data transfer encoding, and a topological vector profile. The use of SDTS is mandatory for Federal agencies after February 15, 1994, although several criteria that require a phased implementation process must be met before the SDTS can be considered for operational use.

- Application profiles must be adopted that will allow the use of a limited subset of SDTS functions with specific data or applications. SDTS application profiles include:
 - The Topological Vector Profile (TVP) issued as Part 4 of revised the SDTS FIPS 173-1 with an effective date of December 30, 1994.
 - A Raster Profile is in draft form and is expected to be finalized in 1994.
 - Profiles for transportation networks, cadastral data, and computer aided drafting & design are being developed.
- Conformance criteria and mechanisms must be established for each adopted application profile. The conformance criteria is established as part of a profile, and it requires the creation and testing of software for each profile to evaluate a data set and determine whether it conforms with the SDTS. Programs are being developed to test encoders and decoders for conformance to the requirements of the SDTS profiles.
- Since the SDTS does not establish a data standard but rather a standard for exchanging data, vendors must ensure their products can accept, convert and/or process SDTS formatted data files. Vendors should have their products certified as SDTS compliant through the National Institute of Standards and Technology.

SDTS contains a Data Quality Module but it does not specify specific content standards for the quality of data. To address this problem, the Federal Geographic Data Committee (FGDC) initiated a project to develop a content standard for spatial metadata in 1992. The

review and testing of the resultant draft standard was completed in early 1994 and the FGDC approved the "*Content Standards for Digital Geospatial Metadata*" on June 8, 1994. The FGDC plans to submit that standard to the Department of Commerce for approval as Federal Information Processing Standard.

The United States Geological Survey (USGS) is the designated maintenance authority for the SDTS and is committed to increasing access to and use of FIPS 173. The USGS is promoting SDTS use through cooperative research and development in the following areas:

- Profile development -- A profile is a clearly defined subset of FIPS 173, designed for use with a specific type of data. The most effective way to use FIPS 173 is first to define a profile; encoding and decoding software can then be designed to handle only the options in that profile. The USGS plans to coordinate the development of profiles to ensure maximum consistency.
- Software development -- the USGS is coordinating the development of public-domain software tools, including a software library designed to support the encoding and decoding of logically compliant SDTS data into and out of the ISO 8211-FIPS 123 general information interchange standard used by the SDTS.
- User guides -- The USGS will coordinate the development of a series of user guides for FIPS 173, for profiles and the profile development process, and for software support tools.
- Workshops and training -- The USGS will continue to conduct SDTS workshops and other presentations to educate spatial data producers and users and to promote the use of SDTS.
- Spatial features register -- Part 2 of the SDTS contains a preliminary list of standard hydrographic and topographic features. The USGS is developing a spatial features register that will serve to update the features in Part 2, as well as define additional categories of features.

FEDERAL INFORMATION ON SDTS

For information on SDTS, FIPS 173-1, or participation in cooperative activities, contact:

U.S. Geological Survey
SDTS Task Force
526 National Center
Reston, VA 22092
FAX 703-648-5542
E-mail: sdts@usgs.gov

When ordering paper copies of SDTS refer to *Federal Information Processing Standards Publication 173-1 (FIPSPUB173-1) - Spatial Data Transfer Standard*. Copies are available from:

National Technical Information Service (NTIS)
Computer Products Office
5285 Port Royal Road
Springfield, VA 22161
703-487-4600

FIPS 173-1 and related documentation are available in electronic form via Anonymous FTP on Internet:

**Internet address: [sdts.er.usgs.gov](ftp://sdts.er.usgs.gov)
(130.11.52.170)
User name: anonymous
After connecting: cd sdts**

File README contains information.

SECTION 2

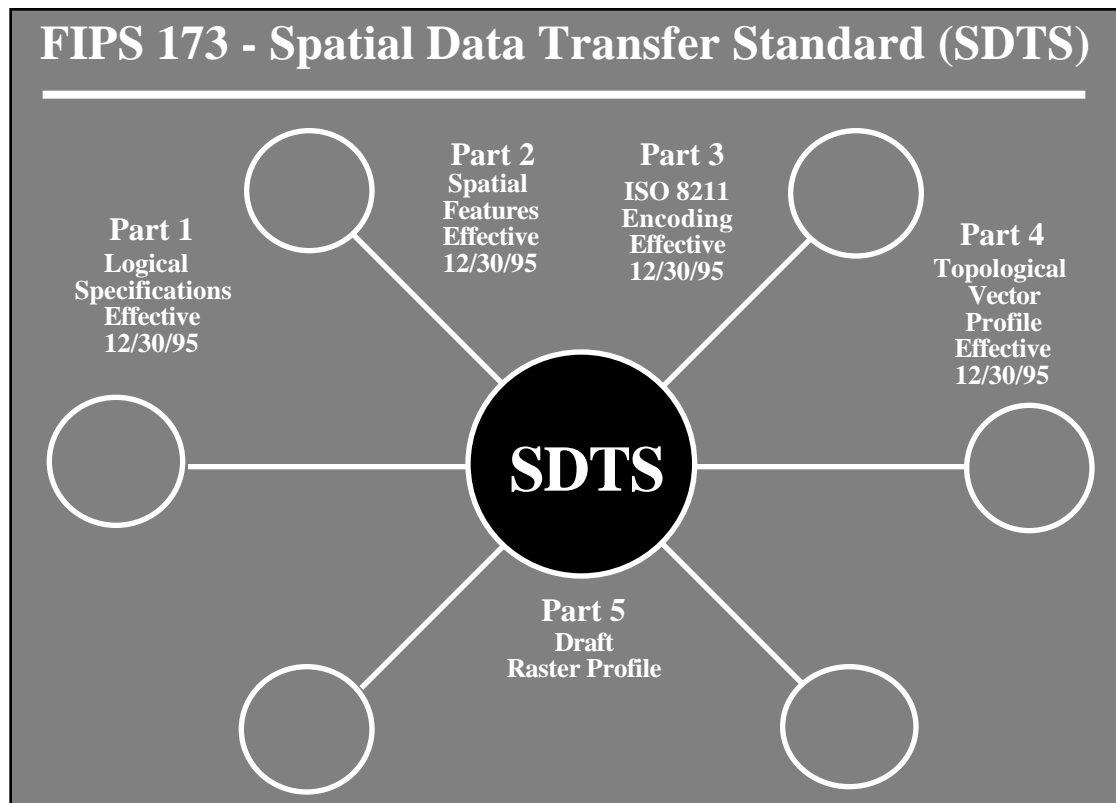
IMPLEMENTING SDTS IN VIRGINIA

PHASED ADOPTION OF THE SDTS FEDERAL STANDARD

The Federal Information Processing Standard (FIPS) 173-1 - Spatial Data Transfer Standard shall be used as the Commonwealth's standard for exchanging digital spatial data.

It is the intent of the Council to closely parallel the implementation of SDTS on the federal level by adopting the provisions of the approved FIPS versions of SDTS and mandating their use by state agencies approximately one (1) year after they are mandatory on federal organizations. Figure-1 shows the mandated effective dates for the four (4) approved parts of SDTS - FIPS 173-1 for the Commonwealth of Virginia.

Figure 1
SDTS Implementation in Virginia



The Part 5 - draft "*raster profile*" is currently being tested and is expected to be finalized in 1994. As appropriate, state agencies should use the February 1, 1994, Draft Part 5 Raster Profile contained in Appendix A as a guideline for the development of raster data sets until a final raster profile is made an approved part of the SDTS.

After December 30, 1995, state agencies that acquire or upgrade automated LIS/GIS software shall ensure that such acquired software products are appropriately SDTS certified by the NIST to meet the provisions of this standard.

While mandatory use of SDTS is required after December 30, 1995, state agencies are encouraged to begin implementing the provisions of this standard at the earliest possible date.

APPLICABILITY OF THIS STANDARD

This standard is for use in the acquisition and development of new Commonwealth of Virginia government applications and programs involving the transfer of digital spatial data between dissimilar computer systems.

The use of the SDTS applies when the transfer of digital spatial data occurs or is likely to occur and one party to the transfer is a state agency.

The use of the SDTS applies to digital spatial data that explicitly contains ground coordinates. It does not apply to the transfer of digital geocoded data files which are not intended to represent spatial entities as digital geographic or cartographic features.

The SDTS is not intended to facilitate product distribution of spatial data in a form designed for direct access by application software specific to a particular data structure, class of computer platform, or distribution media.

Nonstandard features should be used only when the needed operation or function cannot be reasonably implemented with standard features alone. Although nonstandard features can be very useful, it should be recognized that the use of these or any other nonstandard elements may make the interchange of digital spatial data and future conversions more difficult and costly.

State agencies should comply to the extent practical with the specifications for the topological vector profile. However, the creation of polygon topology for network data sets is not required.

Support for the SDTS has developed among the major vendors of geographic information systems. However, SDTS encoding and decoding software is still not widely available. When acquiring or upgrading automated LIS/GIS software, procurement specifications should contain appropriate language that requires the selected software fully support Virginia adopted SDTS profiles no later than the mandated effective date specified in this standard.

All state agency users who may distribute digital spatial data in the future, should review and test how that data fits into the SDTS. State agencies can contact the USGS for conformance testing information and testing assistance. Suggested levels of testing include:

- Work the state agency data through the conceptual model using paper and pencil and see if it fits;
- Prepare a test data set in digital format; and

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- Exchange a test digital data set with another agency and assist that agency in verifying the transferability of the digital data.

SDTS TRAINING IN THE COMMONWEALTH

The Council's Advisory Committee on Mapping, Surveying and Land Information Systems has actively worked with USGS to develop and begin implementing an SDTS training and education plan for the Commonwealth of Virginia.

The objective of the SDTS training and education plan is to:

- Provide users of digital spatial data with information on the SDTS;
- Provide users an understanding of the SDTS's use and applicability in the Commonwealth of Virginia; and
- Prepare Virginia digital spatial data users for the adoption and implementation of SDTS.

The USGS SDTS Task Force is responsible for providing training on the SDTS at the national level and is developing materials to support those efforts. The USGS SDTS training plan identifies three primary target levels for SDTS training:

- High-level program overview of SDTS for managers (session of 1/2 hour, 1 hour or 1/2 day);
- SDTS introduction in five modules, one for each part of the FIPS (one day); and
- Detailed SDTS technical modules for development personnel (three days).

The Virginia SDTS Project Team is a core of individuals who have been trained to provide SDTS overview or introduction training sessions to others. In addition, introductory SDTS training has been provided to the Virginia Association of Planning District Commissions Information Systems Steering Committee. Through this training and the cooperative efforts with the USGS SDTS Task Force, Virginia will be able to utilize the developed expertise and training materials to present the basic information needed to use the SDTS at the state, regional and local government levels in Commonwealth.

State agencies and other organizations interested in receiving SDTS training should complete the SDTS Training Request Form in Appendix B and return it to:

Council on Information Management
Attn: SDTS Training
Washington Bldg., Suite 901
1100 Bank Street
Richmond, VA 23219

CONSIDERATIONS FOR OTHER ORGANIZATIONS

Organizations in Virginia that have a need to exchange digital spatial data with federal or

SPATIAL DATA TRANSFER STANDARD (SDTS)

state government organizations should plan on adopting SDTS.

Organizations in Virginia that currently use digital spatial data developed by federal or state agencies should plan on acquiring or developing appropriate software that supports the implementation of SDTS as outlined in this standard. At a minimum, it is recommended that after December 30, 1995, all such acquired software be SDTS certified by the NIST to meet the mandated effective dates as specified in this standard.

Appendix A

Spatial Data Transfer Standard

Part 5

Raster Profile

Draft 2/1/94

Appendix B Virginia SDTS Training Request

Name: _____

Organization: _____

Division/Department: _____

Address: _____

Phone: _____

Fax: _____

Type of Training Requested

SDTS Overview/Introduction

1/2 hour overview _____

1 hour overview _____

1/2 day overview _____

SDTS Introduction

Part 1 (one day) _____

Part 2 (one day) _____

Part 3 (one day) _____

Part 4 (one day) _____

Part 5 (one day) _____

SDTS Technical Module _____
Training (3 day)

Return to: Council on Information Management, Attn: SDTS Training, Washington Bldg., Suite 901, 1100 Bank Street, Richmond, VA 23219 or Fax to (804) 371-7952.